



ODISHA POWER TRANSMISSION CORPORATION LIMITED

TECHNICAL SPECIFICATION FOR ISOLATORS

400KV HCB SINGLE ISOLATOR WITH 1 EARTH SWITCH

400KV HCB SINGLE ISOLATOR WITH 2 EARTH SWITCH

220KV SINGLE ISOLATOR WITHOUT EARTH SWITCH

220KV SINGLE ISOLATOR WITH EARTH SWITCH

220 KV TANDEM ISOLATOR

132 KV DOUBLE ISOLATOR WITH EARTH SWITCH

132 KV SINGLE ISOLATOR WITH EARTH SWITCH

132 KV SINGLE ISOLATOR WITHOUT EARTH SWITCH

132 KV TANDEM ISOLATOR

33 KV DOUBLE ISOLATOR WITH EARTH SWITCH

33 KV SINGLE ISOLATOR WITHOUT EARTH SWITCH

TECHNICAL SPECIFICATION OF ISOLATORS

| Sl.N O. | Type | 400KV | 220KV | 132KV | 33KV |
|------------|--|------------------------------------|---------------|-----------------|-----------------|
| 1 | Main Switch | HCB | DBCR | | |
| 2 | Service | Outdoor | | | |
| 3 | Applicable standard | IS : 9921 / IEC-129/IEC-62271-102 | | | |
| 4 | Pole | 3 pole gang operator | | | |
| 5 | Rated voltage nominal / maximum | 400/420 | 220/245 | 132/145 | 33/36 |
| 6 | Rated frequency | 50 HZ \pm 5% | | | |
| 7 | System earthing | effectively earthed | | | |
| 8 | Temperature rise | As per relevant IS/IEC publication | | | |
| 9 | Insulation level impulse with stand voltage | | | | |
| (a) | Across Isolating distance (kV peak) | 1665 | 1200 | 750 | 195 |
| (b) | To earthed & between poles (kV Peak) | 1425 | 1050 | 650 | 170 |
| 10 | 1 minute power frequency with stand voltage | | | | |
| (a) | Across Isolating distance (kV Peak) | 610 | 530 | 315 | 80 |
| (b) | To earthed & between poles (kV Peak) | 520 | 460 | 275 | 70 |
| 11 | Max. RIV for frequency between 0.5 MHz and 2 MHz | 1000 at 267kV | 1000 at 156kV | 500 at 92kV | |
| 12 | Corona Extinction Voltage (kV) | 320 | ---- | ---- | ----- - |
| 13 | Rated current | 3150A | 2000A | 2000A/ 1250A | 2000A/ 1250A |
| 14 | Short time current for 3 sec | 63KA | 40KA | 31.5KA | 31.5KA/ 25KA |
| 15 | Operating mechanism | Motor | Motor | Motor | Motor |
| 16(a) | Auxiliary voltage for control, interlock & | 220V DC (80% to 110%) | | | |

| | | | | | |
|-----------|--|--|---------------------------|---------------------------|-------------------|
| | indication | | | | |
| 16(b) | Auxiliary voltage for Motor, heater, lamp & socket | 415V, 3 phase, AC, 50Hz/220V, 1 phase, AC, 50Hz | | | |
| 17(a) | Safe duration of Over load(150% over load | 5 minutes | | | |
| 17(b) | Safe duration of Over load(120% over load | 30 minutes | | | |
| 18 | Insulator Data | | | | |
| a | Bending Strength (kgf) | 800 | 800 | 600 | 600 |
| b | Height (mm) | 3650 | 2300 | 1500 | 508 |
| c | Bottom PCD (mm) | 300 | 254 | 184 | 76 |
| d | Top PCD (mm) | 127 | 127 | 127 | 76 |
| e | Minimum creepage distance of support and Rotating insulators | 10500 mm | 6125 mm | 3625 mm | 900 mm |
| 19 | Phase to phase spacing | 7000 mm | 4500 mm | 3000 mm | 1500m m |
| 20 | Mounting structure | Upright on steel structure | | | |
| 21 | Terminal connector type | Bimetallic if pad is of copper or else aluminium clamp as per requirement & rating | | | |
| 22 | Control | Local / Remote | Local / Remote | Local / Remote | Local |
| 23 | Operating time | 12 second or less | 12 second or less | 12 second or less | 12 second or less |
| 24 | Earth Switch | Local(motorized) / manual | Local(motorized) / manual | Local(motorized) / manual | Manual |

1.SCOPE

This specification provides for design, manufacture, testing at manufacturer's works and delivery ,supervision of erection, commissioning(if required)of following type.

(A) Outdoor type 400KV Horizontal Centre Break Isolator comprises three identical triple pole units which consists of galvanized rigid base made of distortion resistant structural steel having fixing arrangement with the supporting structure

and also having two rotating bearing unit on both sides each base with interconnecting pipe fixing clamps for tandem and link pipe. Porcelain insulators made of composite stacks of rated capacity carrying male & female contact assembly are fixed on the rotating bearing unit of base of each pole. Two units of each pole interconnected by link pipes & finally, all three pole are connected to group operating pipe. Movement of group operating pipe for closing & opening operation of isolator is done by Down pipe connected to the operating mechanism(Motor/Manual). Thus, all three poles of the Isolator shall be mechanically gang operated by a common operating mechanism to ensure that operations of all three poles are simultaneous.

Double Earth Switch should be provided i.e one on Male side & another on Female side. On each side, E/S of all three poles are mechanically ganged with one common motor operating mechanism.

The earthing switches should be of non-ferrous materials especially of the same material as that of main switch assembly and able to carry the same fault current as assigned to the main disconnecter and withstand the dynamic stresses.

If corona extinction voltage is to be achieved with the help of corona ring or any other similar device, the same shall be deemed to be included in the scope of the Supplier.

For each set of Isolator, two sets of clamp connector i.e. one set of clamp connector suitable for 4 inch bus bar & onset of clamp connector suitable for twin moose shall be deemed to be included in the scope of the supplier.

(B) The 220,132 & 33 KV Isolators shall be outdoor type with three phase double break centre rotating type [Single(SI) / Double(DI)] Isolators suitable for electrical as well as manual operation and local/remote operation. They shall have crank and reduction gear mechanism. **Isolator rated for above 72.5 kV shall be of extended mechanical endurance class - M2 as per IEC-62271-102. Isolator rated for 72.5 kV and below shall be of extended mechanical endurance class - M1 as per IEC-62271-102. All earth switches shall be of M0 duty.** All Isolators offered shall be suitable for horizontal upright mounting on steel structures. Each pole unit of the multiple Isolators shall be of identical construction and mechanically linked for gang operation.

Outdoor type 220KV /132KV /33KV, 3 phase triple pole double break gang operated centre rotating type (Single / Double) Isolator with / without earth

switches, with electrical inter lock, insulators and complete in all respect with bimetallic / aluminium connectors arcing horns operating mechanism, auxiliary switches, indicating devices, fixing detail etc. as described herein after.

Each pole of the Isolator shall be provided with two sets of contacts to be operated in series and the moving contact blades shall rotate in horizontal plane. The design shall be such that the operating mechanism with the linkages shall be suitable for mounting on any of the outer pole ends without much difficulty and with minimum shifting of parts.

Moving contacts of all isolators shall rotate through 90 deg from their “fully closed position” to “fully open position so that the break is distinct and clearly visible from ground level.

The Isolators offered by the Bidder shall be designed for Normal rating current for

| | | | |
|----------------|--------|-------------|-------------|
| Isolator 400kV | 220 kV | 132 kV | 33kV |
| 3150A | 2000A | 2000A/1250A | 2000A/1250A |

It should suitable for continuous service at the system voltages specified herein. The Isolators shall be suitable to carry the rated current continuously and full short circuit current of 63/40/31.5/25 KA for 400/220/132/33 KV respectively for 3 second at site condition without any appreciable rise in temperature. These shall also be suitable for operation at 110% rated (normal) voltage. The Isolators shall be suitable for Isolating low capacitive / inductive currents of 0.7amp at 0.15 power factor. The isolators shall be so constructed that they don't open under the influence of short circuit conditions.

The Isolators and earthing switches are required to be used on electrically exposed installation and this should be taken into account while fixing the clearance between phases and between phase and earth.

2. STANDARDS

Disconnecting switches covered by this specification shall conform to latest edition IEC- 62271-102 and unless specifically stated otherwise in this specification.

1. MAIN CONTACTS

All Isolators shall have heavy duty, self-aligning and high pressure line type contacts made of high conductivity, corrosion resistant, hard-drawn electrolytic copper strips of proper thickness and contact area. Contacts should consist of

loops of above copper strips suitable for 2000 Amps ratings. The hard drawn electrolytic copper strips should be silver plated 25 micron thickness and fixed contacts should be backed by powerful phosphor bronze/stainless steel springs of suitable numbers. However, the thickness and contact area of the contact should conform to the drawing approved during type test. Moving contact with moving arm should be of hard-drawn electrolytic copper of proper thickness and contact area for all isolators. However, in case of 400KV HCB Isolator, the moving arms (except the contacts) may be of tubular aluminium of proper cross sectional area. These fixed and moving contacts shall be able to carry the rated current continuously and the maximum fault current of 63/40/31.5/25 KA for 400/200/132/33KV respectively for 3 seconds without any appreciable rise in temperature. The Isolator blades shall retain their form and straightness under all conditions of operation including all mechanical stress arising out of operation as well as under rated short circuit condition.

Fixed guides shall be provided so that even when the blades are out of alignment by one inch (maximum), closing of the switches, proper seating of the blades in between contacts and adequate pressure to give enough contact surface is ensured. Wherever possible, the blades shall be counter balanced by weights and springs. The contact shall be self cleaning by the wiping action created by the movements of the blades. The surface of the contacts shall be Bided smooth and silver plated (25 micron).

The Isolator shall be self-cleaning type so that when isolators remain closed for long periods in a heavily polluted atmosphere, binding does not occur. No undue wear or scuffing shall be evident during the mechanical endurance tests, contacts and springs shall be designed so that adjustment of contact pressure shall not be necessary throughout the life of the isolator. Each contact or part of contacts shall be independently sprung so that full pressure is maintained on all contact at all times.

2. ARCING HORN AND GRADING HORN

Suitable arcing horn made of tinned electrolytic copper which are required for guiding contacts shall be provided on the fixed and moving contacts of all Isolators. The contacts shall be of ‘make before and break after” type.

3. ELECTRICAL INTERLOCK / MECHANICAL INTERLOCK

The disconnecting switches whenever required shall be with an approved type electrical interlock for interlocking with the associated circuit breakers and earth switch. Electrical interlock assembly should be more right in construction and

properly mounted to ensure reliable operation. The design should be such that the electrical circuit for the interlocking mechanism will only remain energised during operation of the switches.

4. AUXILIARY SWITCHES

All isolators and earthing switches shall be provided with 220V DC auxiliary switches for their remote position indication on the control board and for electrical locking with other equipment. The auxiliary switch shall be provided with a minimum of ten auxiliary contacts-10 normally open and 10 normally closed and 10 normally open and 10 normally closed for earth switch. Separate auxiliary switches shall be provided for isolating and earth switches. 6 additional NO and NC contact to be provided as spare in each case.

The auxiliary switches and auxiliary circuits shall have a continuous current carrying capacity of at least 10 Amps. Auxiliary switches shall not be used as limit switches. Details of make, rating and type of limit switch shall be furnished in the offer.

5. EARTH SWITCH

Line earth switch shall consist of three earthing blades for Isolator which normally rest against the frame when the connected Isolator is in closed position. The earthing blades for three phase shall be mechanically linked to a coupling shaft which shall be capable of being fitted on either side of the Isolator. The earthing blades shall match and be similar to the main switch blades and shall be provided at the hinge; with suitable flexible conductors at all moving points with terminal lugs to maintain a continuous path to the station ground bus. The earthing blades shall be operated by a separate mechanism but shall be mechanically interlocked with the main switch so that the earthing blades can be closed only when the main switches are in open position and vice-versa. The earthing blades shall be gang operated and all the three blades will operate simultaneously. **245 kV earth switches shall also comply with the requirements of IEC-62271-102, in respect of induced current switching duty as defined for Class-B and short circuit making capability class E-0 for earthing switches.**

6. OPERATING MACHANISM

The operating mechanism shall be simple and shall ensure quick and effective 1000 operation. The design shall be such as to enable one man to operate it with nominal effort. The operating mechanism box shall be made out of aluminum extruded (Aluminum alloy) sections of minimum 3.0 mm thickness. The operating mechanism shall be strong rigid and not subject to rebound.

The Isolator blades shall be in positive continuous control throughout the entire cycles of operation. The operating rods and pipes shall be rigid enough to maintain positive control under most adverse conditions and to withstand all torsional and bending stresses arising from operation. Operation of the switches at any speed should not result in improper functioning, in displacement of parts / machines after final adjustment has been made. All holes in cranks, linkages etc. having moving pins shall be drilled and fitted accurately so as to prevent slackness and lost motion.

Provision shall be made for padlocking the operating mechanism of disconnecting and earth switches in both open and closed positions.

Bearings shall be ball and roller type shall be protected from weather and dust by means of cover and grease retainers. Bearings pressures shall be kept low to ensure long life and care of operation.

Each power operated isolator shall be motor driven as well as manually operated and shall be complete with local / remote selector switch and open / close push buttons. The function of all control facilitates operating isolators.

Provision shall be made in the control cabinet to disconnect power supply to prevent local / remote power operation. Limit switches for open and close positions of isolators shall be provided.

All the terminal blocks to be used in the operating mechanism should of stud type of Poly-amide/Mealmine material of make like Elmex (OAT-6 for non disconnecting type & OAT -6T for disconnecting type) / connectwell (Equivalent).

7. DESIGN, MATERIALS AND WORKMANSHIP

The live parts shall be designed to eliminate sharp points, edges and similar corona producing surfaces. Where this is impracticable, adequate shields to be provided. All ferrous metal parts shall be hot dip galvanized, as per IS 2629. All metal parts shall be of such materials or treated in such a way so as to avoid rust, corrosion and deterioration due to continued exposure to atmosphere and rain. All current carrying parts shall be made from high conductivity electrolytic copper / aluminium.

Bolts, screws and pins shall be provided with standard locking device viz. Locknuts, spring washers, keys etc. and when used with current carrying parts, they shall be made of copper silicon or other high conductivity and wear resistant alloys.

The switches should not need lubrication of any parts except at very long interval of five year minimum.

8. PROTECTIVE COATINGS

All ferrous parts including bolts, nuts and washers of the switches assembly shall be galvanised to withstand at least six one minute dips in copper sulphate solution of requisite strength (Prece tests) except the threaded portions which should withstand four dips.

9. Insulators – Support insulators for all type of isolators shall be of solid core type. The insulator shall be made of homogeneous and vitreous porcelain of high mechanical and dielectric strength. It shall have sufficient mechanical strength to sustain electrical and mechanical loading on account of wind load, short circuit forces etc. Glazing of the porcelains shall be of uniform dark brown colour with a smooth surface arranged to shed away rain water. The porcelain shall be free from laminations and other flaws or imperfections that might affect the mechanical or dielectric quality. It shall be thoroughly vitrified, tough and impervious to moisture. The porcelain and metal parts shall be assembled in such a manner and with such material that any thermal differential expansion between the metal and porcelain parts throughout the range of temperature specified in this specification shall not loosen the parts or create under internal stresses which may affect the mechanical or electrical strength or rigidity. The assembly shall not have excessive concentration of electrical stresses in any section or across leakage surfaces. The cement used shall not give rise to chemical reaction with metal fittings. The insulator shall be suitable for water washing by rain or artificial means in service condition. Profile of the insulator shall also conform to IEC-815. Insulator shall have a minimum cantilever strength of **800 kgf (for 400Kv, 220 Kv) & 600 Kgf for (132KV,33 Kv)**. Caps to be provided on top of the insulator shall be of high grade cast iron or malleable steel casting. It shall be machine faced and hot dip galvanized. The cap shall have four numbers of tapped holes spaced on a pitch circle diameter of 127mm. The holes shall be suitable for bolts with threads having anti corrosive protection. The effective depth of threads shall not be less than the nominal diameter of the bolt. The cap shall be so designed that it shall be free from visible corona and shall have radio interference level within 500 micro volts for 220 Kv & 132 Kv .Casing shall be free from blow holes cracks and such other defects

If corona extinction voltage is to be achieved with the help of corona ring or any other similar device, the same shall be deemed to be included in the scope of the Supplier

10. Control Cabinet: The control cabinet of the operating mechanism shall be made out of minimum 3mm thick aluminium alloy sheet. Hinged door shall be provided with pad locking arrangement. Flexible earthing strips to be provided for moving shaft connecting to the isolator with cabinet body as well as the hinged door with main body. Sloping rain hood shall be provided to cover all sides. 15 mm thick neoprene or better type of gaskets shall be provided to ensure degree of protections of at least IP 55 as per IS 2147/IS-3947. The cabinet shall be suitable for mounting on support structure with adjustment for vertical, horizontal and longitudinal alignment. Details of these arrangements shall be furnished alongwith the offer.
11. Motor : Motors rated 1 Kw and above shall be suitable for operation on 3 phase, 415 V, 50 HZ supply. Motors of lower rating shall be single phase type suitable for 240V, 50HZ system. It shall be totally enclosed type if mounted outside the control cabinet. The motor shall withstand without damage stalled torque for atleast 3 times the time lag of tripping device. The motor shall, in all other respects, conform to the requirement of I.S. 325.
12. Gear : The dis-connector / isolator may be required to operate occasionally, with considerably long idle intervals. Special care shall be taken for selection of material for gear and lubrication of gears to meet this requirement. The gear shall be made out of aluminium bronze or any other better material lubricated for life with graphite or better quality non-drawing and non-hardening type grease. Wherever necessary automatic relieving mechanism shall be provided suitable relay, Device shall be provided to prevent over loading of the motor. Single phase preventer (for 3 phase meter) shall be provided to operate on open circuiting of any phase and shall trip off the motor. Complete details of the devices shall be furnished in the offer.
13. Space heaters : Space heaters suitable for 1 phase 240V AC supply shall be provided for each motor operated operating mechanism to prevent condensation and shall be operated by MCB.
14. Terminal block and Wirings – Each operating mechanism shall be provided with 1100V grade stud type terminal block. All auxiliary switches, interlocks and other terminals shall be wired upto terminal block. The terminal block

shall have at least 20% extra terminals. All wiring shall be carried out with 1.1KV grade insulated 2.5 sq mm copper wires.

15. Interior Illumination : A holder suitable for a 240 V lamp shall be provided in each of the motor operated mechanism of three poles & shall be door operated type.
16. Control and auxiliary supply – A 3 phase switch with MCB for phases and link for neutral, shall be provided for power supply and a 2 pole MCB shall be provided for control supply.
17. Position indicator : A position indicator to show the isolator is in ON or OFF position to be provided.
18. Name plate : Isolator, earthing switches and their operating devices shall be provided with name plate. The name plate shall be weather proof and corrosion proof. It shall be mounted in such a position that it shall be visible in the position of normal service and installation. It shall carry the following informations duly engraved or punched on it.

A. Isolator Base

Name : OPTCL

Name of manufacturer –

Order No. –

Type Designation –

Manufacturers serial No. –

(Confirming to IS)

Rated voltage –

Rated normal current –

Rated short time current (rms) and duration –

Rated short time peak current (KAP)

Weight

B. Earthing Switch

Name : OPTCL

Name of manufacturer –

Order No. –

Type Designation –

Manufacturers serial No. –

(Confirming to IS)

Rated voltage –

Rated normal current –

Rated short time current (rms) and duration

Rated short time peak current (KAP)

Weight

C. Operating Device

Name – OPTCL

Name of manufacturer –

Order No.

Type Designation –

Reduction gear ratio –

AC motor

- i) Rated auxiliary voltage
- ii) Starting current
- iii) Designation of AC motor as per I.S 4722/325
- iv) Starting torque at 80% of supply voltage
- v) Over travel in degrees after cutting off supply

Total operating time in seconds

- i) Close operation – Electrical
- ii) Open operation – electrical
Open operation – manual

19. Painting Galvanizing and Climate Proofing

At interiors and exteriors of enclosures, cabinets and other metal parts (other than made up of aluminium) shall be thoroughly cleaned to remove all rust, scales, corrosion, grease and other adhering foreign matter and the surfaces treated by phosphating (e.g. seven tank phosphating sequence). After such preparation of surfaces, two coats of zinc oxide primer shall be given by suitable stoving and air drying before final painting. Colour of the final paints shall be of shade no. 697 of IS:5. The finally painted cubicle shall present aesthetically pleasing appearance free from any dent or uneven surface.

Paint inside the metallic housing shall be of anti condensation type and the paint on outside surfaces shall be suitable for outdoor installation.

All components shall be given adequate treatment of climate proofing as per IS:3202 so as to withstand corrosive and severe service conditions.

All metal parts not suitable for painting such as structural steel, pipes, rods, levers, linkages, nuts and bolts used in other than current path etc. shall be hot dip galvanized as per IS -2629. Galvanisation test will be carried out during routine test.

Complete details of painting, galvanising and climate proofing of the equipment shall be furnished in the offer.

24. **TESTS**

Type Tests

Isolators offered, shall be fully type tested as per the relevant standards. The Bidder shall furnish Three sets of the following valid type test reports for their different type of offered Isolators along with the offer. The Purchaser reserves the right to demand repetition of some or all the type tests in the presence of purchaser's representative. For this purpose the Bidder may quote unit rates for carrying out each type test and this will be taken during bid price evaluation, if required.

- a) Short time withstand & peak withstand current test for Isolator & Earth Switch.
- b) Power frequency (Dry & Wet), Lightning Impulse dry withstand Test
- c) Mechanical endurance Test (M2 class).
- d) IP-55 test.
- e) Temperature rise.
- f) Seismic withstand test.
- g) Induced current test (Class-B) as per IEC 62271-102. (For 220 KV class Isolators).
- h) RIV test. (132 KV & above).

During type tests the isolator shall be mounted on its own support structure or equivalent support structure and installed with its own operating mechanism to make the type tests representative. Drawing of equivalent support structure and mounting arrangements shall be furnished for Purchaser's approval before conducting the type tests.

The type tests shall be conducted on the isolator along with approved insulators and terminal connectors.

Mechanical endurance test shall be conducted on the main switch as well as earth switch of one isolator of each type.

Acceptance and Routine Test :

All acceptance and routine test as stipulated in the relevant standards shall be carried out by the supplier in presence of Purchaser's representative.

Mechanical operation test (routine test) shall be conducted on isolator (main switch and earth switch) at the supplier's works as well as purchaser's substation site.

Immediately after finalisation of the programme of type / acceptance, routine testing the supplier shall give sufficient advance intimation (clear 20 days advance intimation), along with shop routine test certificates, valid calibration reports from Govt. approved test house for the equipments, instruments to be used during testing for scrutiny by the purchaser to enable him to depute his representative for witnessing the tests. If there will be any discrepancies in the shop routine test certificates and calibration reports furnished by the firm then after settlement of the discrepancies only, purchaser's representative will be deputed for witnessing the tests.

Special tests proposed to be conducted (if decided to conduct) as type test on isolators, are given at Annexure- II. These special type test charges shall be quoted alongwith all other type tests as per relevant IEC standard and these charges shall be included in the total bid price.

Test certificates of various items including but not limited to the following shall be furnished at the time of routine tests.

- a) Chemical analysis of copper alongwith a copy of excise certificate indicating genuine source of procurement of electrolytic grade copper.
- b) Bearings
- c) Fasteners
- d) Universal / swivel joint coupling
- e) Insulators
- f) Motor
- g) Gears
- h) Auxillary switch
- i) Limit switch
- j) Timer
- k) Overload / single phase preventer relay
- l) Interlocking devices
- m) Terminal block
- n) Any other item

25. INSPECTION

i) The Purchaser shall have access at all times to the works and all other places of manufacture, where the disconnectors, earth switches and associated equipment are being manufactured and the supplier shall provide all facilities for unrestricted

inspection of the works raw materials manufacture of all the accessories and for conducting necessary tests as detailed herein.

- ii) The supplier shall keep the purchaser informed in advance of the time of starting of the progress of manufacture of equipment in its various stages so that arrangements could be made for inspection.
- iii) No material shall be dispatched from its point of manufacture unless the material has been satisfactorily inspected and tested.
- iv) The acceptance of any quantity of the equipment shall in no way relieve the supplier of his responsibility for meeting all the requirements of this specification and shall not prevent subsequent rejection if such equipment are later found to be defective.

26 QUALITY ASSURANCE PLAN

The Bidder shall invariably furnish following information alongwith his offer, failing which his offer shall be liable for rejection.

- (i) Names of sub suppliers for raw materials, list of standards according to which the raw materials are tested, list of tests normally carried out on raw materials in presence of Supplier's representative, copies of test certificate
- (ii) Information and copies of test certificates as in (I) and (ii) above in respect of bought out accessories.
- (iii) List of manufacturing facilities available
- (iv) Level of automation achieved and lists of areas where manual processing still exists.
- (v) List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.

List of testing equipments with calibration certificates from Govt. approved test house available with supplier for final testing equipment and test plant limitation if any, vis-à-vis the type, special acceptance routine test specified in the relevant standards. These limitations shall be very clearly brought out in the specified test requirements.

The supplier shall within 30 days of placement of order, submit following information to the purchaser.

- i) List of raw material as well as bought out accessories and the names of sub-suppliers selected from the lists furnished alongwith offer.

- ii) Type test certificates of the raw material and both bought out accessories.
- iii) Quality Assurance Plan (QAP) with hold points for purchaser's inspection.

The supplier shall submit the routine test certificates of bought out accessories and raw material viz. Copper, aluminium conductors, lubricating material, gear material etc. at the time of routine testing of the fully assembled isolator.

27. DOCUMENTATION

All drawings shall conform to relevant international standards organisation (ISO). All drawings shall be in ink and suitable for micro filming. All dimensions and data shall be in S.I. Units.

List of Drawings and Documents

The Bidder shall furnish four sets of following drawings / documents along with his offer.

- a) General outline and assembly drawings of the dis-connector operating mechanism, structure, insulator and terminal connector.
- b) Sectional views and descriptive details of items such as moving blades, contacts, arms contact pressure, contact support bearing housing of bearings, balancing of heights, phase coupling pipes, base plate, operating shaft, guides, swivel joint operating mechanism and its components etc.
- c) Loading diagram
- d) Drawings with structure for the purpose of type tests.
- e) Name plate.
- f) Schematic drawing.
- g) Type test reports.
- h) Test reports, literature, pamphlets of the bought out items and raw material.

The supplier shall within 2 weeks of placement of order submit four sets of final versions of all the above said drawings for Purchaser's approval. The purchaser shall communicate his comments / approval on the drawings to the supplier. The supplier shall, if necessary, modify the drawings and resubmit four copies of the modified drawings for Purchaser's approval within two weeks from the date of comments. After receipt of approval the supplier shall within three weeks submit 15 prints and two good quality re-producibles of the approved drawings for purchaser's use.

Six sets of the type test reports, duly approved by the Purchaser shall be submitted by the supplier for distribution, before commencement of supply Adequate copies of

acceptance and routine test certificates, duly approved by the Purchaser shall accompany the despatched consignment.

The manufacturing of the equipment shall be strictly in accordance with the approved drawings and no deviation shall be permitted without the written approval of the purchaser. All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawing shall be at the supplier risk.

28. INSTRUCTION MANUALS :

Fifteen copies of the erection, operation and maintenance manuals in English be supplied for each type of disconnecter one month prior to despatch of the equipment. The manual shall be bound volumes and shall contain all drawings and information required for erection, operation and maintenance of the disconnecter including but not limited to the following particulars.

- (a) Marked erection prints identifying the component parts of the disconnecter as shipped with assembly drawings.
- (b) Detailed dimensions and description of all auxiliaries.
- (c) Detailed views of the insulator stacks, metallics, operating mechanism, structure, interlocks, spare parts etc.

29. PACKING AND FORWARDING.

The equipment shall be packed in crates suitable for vertical / horizontal transport, as the case may be and suitable to withstand handling during transport and outdoor storage during transit. The supplier shall be responsible for any damage to the equipment during transit, due to improper and inadequate packing. The easily damageable material shall be carefully packed and marked with the appropriate caution symbols. Wherever necessary, proper arrangement for lifting, such as lifting hooks etc. shall be provided. Any material found short inside the packing cases shall be supplied by supplier without any extra cost.

Each consignment shall be accompanied by a detailed packing list containing the following information :

- (a) Name of the consignee.
- (b) Details of consignment.
- (c) Destination.
- (d) Total weight of consignment.
- (e) Handling and unpacking instructions.
- (f) Bill of material indicating contents of each package.

The supplier shall ensure that the bill of material is approved by the purchaser before despatch.

30. SUPERVISION OF ERECTION TESTING AND COMMISSIONING (ET & C)

Purchaser proposes to utilize the services of the supplier for supervision of testing and commissioning of the equipment being supplied by him, if it is required. For this purpose, the supplier should make available the services of trained personnel (Engineers) who shall correct in the field, any errors or omissions in order to make the equipment and material properly perform in accordance with the intent of this specification. The Engineer shall also instruct the plant operators in the operation and maintenance of the commissioned equipment. The supplier shall be responsible for any damage to the equipment on commissioning the same, if such damage results for the faulty or improper ET&C. Purchaser shall provide adequate number of skilled / semi skilled workers as well as ordinary tools and equipment and cranes required for equipment erection, at his own expenses. Apart from the above, the Purchaser shall not be responsible for providing any other facilities to the supplier. Special tools if required for erection and commissioning shall be arranged by the supplier at his cost and on commissioning these shall be supplied to the purchaser free of cost for future use.

APPENDIX – I(Isolators)

LIST OF SPECIAL TESTS TO BE CARRIED OUT IF DECIDED BY THE PURCHASER

| Sl. No. | Name of the Test | Standard to which it conforms. |
|---------|---|--|
| 1. | Test for visible Corona and Radio interference voltage (RIV) on disconnectors and terminal connector. | NEMA Pub No. 107-1964 ISRI Pub No. 1-1972 |
| 2. | Tests on insulators | IS-2544 IEC. 168 |
| 3. | Tests on terminal connectors | IS:5561 |
| 4. | Tests on galvanised components | IS:2633 |
| 5. | Stalled torque test on motor operating mechanism | At 110% of supply voltage |

**GUARANTEED TECHNICAL PARTICULARS FOR DISCONNECTOR
(ISOLATORS)**

(To be filled in separately for Disconnectors of different voltage classes and types)

1. Type / installation
2. Manufacturer's Name and
Country of manufacture
3. standard/s according to which
the isolator are manufactured
4. Maximum design voltage at which
the isolator can operate (kv)
5. frequency (Hz)
6. Rated Voltage (kv)
7. Max. current that can be safely interrupted by the isolator
Inductive (A & % PF)
Capacitive (A & % PF)
8. Continuous current rating (Amps)
9. Rated short time current
 - (i) For 3 second (KA rms)
 - (ii) Rated peak short time current (kVp)
10. Current density at the minimum cross-section of
 - a) Moving blade (Amps/Sq.mm)
 - b) Terminal pad
 - c) Contacts
 - d) Terminal Connector
11. Max. temp rise of current carrying parts when carrying rated current
continuously. (deg. C)
12. factor for specified site conditions.
13. Derating Insulation levels.
 - i) Impulse withstand voltage (kV peak)
 - a) Phase to Earth
 - b) Across isolating Distance
 - ii) Switching surge withstand voltage (kV peak)
 - (a) Phase to Earth
 - (b) Across isolating Distance
 - iii) Power frequency withstand voltage (kV rms)

- (a) Phase to Earth
- (b) Across isolating distance
- iv) Radio interference voltage at 1.1 times maximum line to ground voltage (micro volts)
- v) Corona inception voltage (kV rms)
- vi) Corona extinction voltage (KV rms)
- 14. Minimum clearance in air:
 - i) Between poles (mm)
 - ii) Between live parts and earth (mm)
 - iii) Between live part when switch is open
 - (a) On the same pole (mm)
 - (b) Between adjacent poles (mm)
- 15. Rated mechanical terminal load
 - i) Load along the terminal connector side (kg)
 - ii) Load across the terminal connector side(kg)
- 16. Torque required to operate the switch in Kg. m.
- 14. Contact zone
 - (i) Horizontal deflection (mm)
 - (ii) Vertical deflection (mm)
 - (iii) Total amplitude of longitudinal movement w.r.t. conductor supporting fixing contact (mm)
- 15. Design and Construction
 - i) No. of Insulators per pole
 - ii) Contacts
 - a) Material and grade
 - b) Cross-sectional area in sq.mm
 - iii) Moving Blades
 - a) Material and grade
 - b) Cross sectional area
 - iv) Contact Support
 - a) Material and size of channel / block
 - b) Material and size of plate
 - v) Rain hood – Material grade and size
 - vi) Turn and twist mechanism
 - a) Material and size of clamps
 - b) Material and size of springs

- c) Whether springs are encased
- vii) Nuts and Bolts.
 - a) Size, material and grade in live parts.
 - b) Size material and grade in other parts
- viii) Insulator base plate

Material and size of plate below insulators

- ix) Bearings.
 - a) Material and size of housing
 - b) No. of bearings, location and size
- x) Tandem pipe
 - a) Size class and no. of pipes
 - b) Size of shackle, screw
 - c) No. of bearings / bush and its material and size
- xi) Type of inter lock
- xii) Down pipe size and class
- xiii) Type of universal / swivel joint
 - a) Between bearing and down pipe
 - b) Between down pipe and operating mechanism
- xiv) Operating mechanism
 - a) Control cabinet

Material and thickness

Degree of protection

Type size and no. of cable glands

Whether removable gland plate provided.

- b) Make type, rating and qty. of motors per isolator

Gears

Limit switches

Contactors

Over load relay

Single phase preventor

Auxiliary switch

Terminal blocks

Insulator wires

HRC fuses

Pole discrepancy relay

Timer

Space Heater

Interlocks

xv) Insulators

- a) Make, Type
- b) No. of units per insulator stack.
- c) Rating of insulator (kV)
- d) Height of each insulator stack (mm)
- e) Bolt circle diameter (mm)
- f) Tensile strength (kg)
- g) Compressive strength
- h) Torsional strength (kg. m)
- i) Cantilever strength upright (kg)
- j) Power frequency dry flash over voltage (kV) rms
- k) Power frequency wet flash over voltage (kV) rms
- l) Power frequency puncture voltage (kV) rms
- m) Impulse flash over voltage (positive wave) (kV) peak
- n) Impulse withstand voltage (kV) peak
- o) Power frequency withstand voltage (kV) rms
- p) Visual discharge voltage level (kV) rms
- q) Creepage distance, Total (mm), Protected (mm)
- r) Dry arcing distance (mm)

xvi) Base

- a) Size of steel sections used**
- b) Overall size**
- c) Total weight**

xvii) Terminal connectors

- a) Clamp Body**

Alloy Composition

Plating if any

Area at min. cross section

b)Bolts and nuts size

Alloy composition

Tensile strength

c)Type of washers used

d)Materials of braids

e)Temperature rise when carrying rated current at 50 deg. C ambient (deg.C)

f)Weight of each type of clamp (kg)

**xviii) Resistance of main circuit
as per the type test report**

XIX)Conductivity of HDE copper

19.0 List of bought out items.

| Sl. No. | Particulars of components | Qty. | Rating | Make | Type |
|------------|---------------------------|------|--------|------|------|
|------------|---------------------------|------|--------|------|------|

20.0 List of test certificates (Type and routine)

21.0 List of drawings furnished.

Name of the firm

Signature of Bidder

Designation and seal

Date